STAFF DEVELOPMENT METHODS FOR PLANNING LESSONS WITH INTEGRATED TECHNOLOGY

Jennifer Miers Heine, B.A., M.A.T.

Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

December 2002

APPROVED:

James Laney, Major Professor
Mark Mortensen, Minor Professor
Diana Bernshausen, Committee Member
John Stansell, Chair of the Department of Teacher Education and Administration
M. Jean Keller, Dean of the College of Education
C. Neal Tate, Dean of the Robert B. Toulouse School of Graduate Studies

ACKNOWLEDGEMENT

It would never have occurred to me that it was possible to complete this kind of undertaking without the lifelong example set by my parents who have never allowed me to consider that something wasn't possible. I have been further blessed with a husband with endless patience and who offers truly unconditional support and love. There are no words to properly acknowledge the motivation that these three people inspire.

Many people at UNT also helped me get through this process. Thanks to Dr. Patricia Moseley who was my advisor from my first semester through my proposal, and answered every question from beginning to end. Thanks to Dr. Jim Laney for picking up where she left off, and making sure all loose ends were tied up. Thanks to Dr. Diana Bernshausen for constant pep talks, both on my student life stress and my professional life stress, and for making sure I did not quit. Thanks to Dr. Mortensen for always assuring me that I was not the only one ever to rewrite and rewrite and rewrite and I would finish one day. Finally, thanks to my committee members, as well as Dr. John Stansell, Dr. Larry Daniel, and Dr. Ron Wilhelm for being great teachers. I always looked forward to nights when I had class.

Thanks, also, to those at Greenwood Hills Elementary who tolerated being a part of many an assignment, and Principal Becky Barnum who allowed me to be a teacher and a student. I'm also grateful to those at Melissa Ridge Elementary who agreed to participate in my dissertation study before they even met me, and Principal Terri Kirkman who convinced them to do so.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

The Texas Essential Knowledge and Skills (TEKS) provide teachers with a state-mandated curriculum for their grade level or subject area. In addition to the main subject area TEKS there are also Technology Applications (TA) TEKS which teachers are expected to teach. Many teachers view technology as “one more thing” they are expected to teach, and, particularly in Kindergarten through third grade, feel that reading, writing, and computation skills are much more important than computer skills in grades K-3. The problem of meeting the expectations laid out in the TA TEKS is compounded by limited teacher proficiency in the areas of technology which teachers are expected to use with their children.

To meet the state curriculum requirements, and prepare students for computer use at the secondary level, it is essential that elementary school teachers integrate the Technology Applications curriculum with the core subject areas. This provides meaning for the students, and gives a framework for assimilating the new technology and core subject area information (Norton and Wiburg, 1998). There is a much more practical reason that integration is needed, however: time. At the elementary level, one teacher may be expected to cover TEKS in reading, language, social studies, health, science, math, and now technology. Clearly integration is the only means to accomplish all of this. Computers can be a valuable tool in tying the subject areas together, decreasing teacher workload and covering the state curriculum.

In 1999 Foa, Schwab and Johnson reported that, despite 50% of schools having Internet connectivity, only 7% of teachers were using the Internet to teach. In their article, “Introducing Technologies Into the Schools: Triumph or Train Wreck”, they suggested that simply providing the technology is not adequate. Training is needed to bring about the integration of computer technology with the other curricular areas. Furthermore, attention must be given to the needs of adult learners, and training must be "on-site, individualized, and teacher-oriented" (p.2). Additionally, these authors suggest that "social and emotional aspects of learning cannot be ignored" (p.4). They go on to say that teachers progress through the change process faster when they have supportive bonds of colleagues to act as a support system.

Their findings are further supported by standards of the National Staff Development Association (NSDA) (1995), which state that adult learners must understand how innovations, such as computer technology, integrate with what they are already doing. The NSDA standards also state that new learning can take place through discussion, observation, training and experimentation.

In a follow-up to their previous article, Schwab and Foa (2001) reported the progress made by their attempts at training teachers in 14 states to integrate computers into their teaching. They found that simply training teachers to use the computers was not sufficient, because the teachers must also have training specifically in integrating computer technology with their teaching. Furthermore, on-site training and follow-up was key to keeping the innovations going within the schools, and they found that peer support played a significant role in helping teachers to integrate computers into their curriculum.

Although research in the past few years has begun to illuminate the effective staff development methods for training teachers to use computers, more study is needed in effective training on integrating computers into the other curricular areas.

Statement of the Problem

Technology staff development for teachers has predominantly focused on improving participants' skills in the use of technology. Additionally, the most commonly used staff development models have not addressed the social nature of learning. Improved staff development methods are needed to (1) train teachers to work cooperatively to improve the use of technology in the classroom, and to (2) train teachers not only in technology use, but also in methods of integrating technology into their curriculum.

Purpose of the Study

The purpose of this study is to compare staff development methods to determine whether a cooperative model of staff development is more effective than individual training in helping teachers learn to develop lessons in which they integrate technology with the other curricular areas.

Null Hypotheses

1. There is no statistically significant difference between occasion one (the pre-training lesson plans of teachers trained either individually or cooperatively in technology integration) and occasion two (the post-training lesson plans of teachers trained either individually or cooperatively in technology integration).
2. There is no statistically significant difference for the interaction between group assignment (individual technology integration training versus cooperative technology integration training) and the occasion (pre- versus post-technology integration training).

Importance of the Study

This study is important to extend current research into the area of training teachers to integrate technology. Current research focuses primarily on increasing teacher proficiency in technology, but very little study has been done on training them to integrate technology. This study will also synthesize the research on effective teacher training methods with methods for training teachers to integrate technology.

Definition of Terms

1. Cooperative staff development (Glatthorn, 1987) is defined as teams of two or three teachers who will be trained to work together and provide a support system for one another in order to more effectively integrate technology into their curriculum.
2. Computer integration (Moersch, 1999) is defined as the use of technology for research, lesson planning, multimedia and graphical presentations and simulations and to correspond with experts, and peers and parents, to facilitate student learning of both technology skills and other subject area curricula simultaneously.
3. Training and staff development are both used to describe the one-hour sessions, as well as informal contacts with colleagues regarding technology integration.
4. On-site staff development is defined as staff development which takes place at the school where the teacher is assigned to teach.

Limitations of the Study

This study was limited due to the fact that the teachers could be required to participate in the study to completion. The study is also limited because the sample was drawn from a single elementary school.

Summary of Methods and Procedures

Teachers at an elementary school attended three staff development sessions at their campus in which they were trained in methods to integrate technology into the other curricular areas. Prior to the training each participant's Level of Technology Implementation (LoTi)

(Moersch, 1995) was determined based on lesson plans submitted by the participants. Three raters rated the lesson plans using the Instructional Technology Implementation Observation (Moersch, 2001) to determine the Level of Technology Implementation for each participant. These three ratings were added together for a score from 0, for non-use, to 18, for the highest Level of Technology Implementation. Teachers were randomly assigned to the control or experimental group. Though the content of each session was the same, the control group attended three different sessions from the experimental group. The teachers in the experimental group worked with a partner at all three sessions to brainstorm and develop lessons. Teachers in the control group, teachers worked individually. Upon completion of training sessions each teacher or team submitted a second lesson plan. These lesson plans were then rated again to assess the participants' Level of Technology Implementation. These data were then analyzed using a mixed model ANOVA to determine if there had been a change in the participants Level of Technology Implementation. The ANOVA was also analyzed to determine if the change differed in the group that worked cooperatively from the group that worked individually to determine whether training teachers cooperatively increases their ability to effectively write lesson plans with integrated technology.

CHAPTER 2

REVIEW OF LITERATURE

Studies of effective teacher training began long before computers, as we know them today, were a part of education. More recently, some work has been done in investigating effective use of computers in teaching. This review will discuss research in the areas of cooperative learning among teachers, teacher attitudes toward the use of technology, teacher proficiency in using technology, the integration of computers into the curriculum, and the change process as it relates to integrating computers into the curriculum.

Effective Teacher Training

Effective teacher training is an area that has been studied extensively, and long before computers, as we know them now, became a part of the educational environment. Recent research cites some important components that have been repeatedly found to be effective methods of training adult learners. These effective strategies fit within the broader Readiness, Planning, Training, Implementation, Maintenance (RPTIM) Staff Development Model (Zepeda, 1999). The first step of this model is the Readiness stage in which a climate of support for the change is developed. Next Planning is needed, in which decisions are made about time and funding needed for the training. Next is the training phase itself in which a schedule should be developed and followed, and administrative support for the training must be in place. Next is the implementation phase in which teachers should be supported as they implement the new learning in the classroom, and finally in the maintenance phase. Although all the stages of the RPTIM model must be in place for successful implementation of a new program, such as integration of computers with the other curricular area, this study focuses on the most effective methods of the training phase of this model. Training is as important in technology integration as the technology itself (Foa, Schwab, and Johnson, 1999). Research also suggests that training must be on-site, individualized, and teacher-oriented (Foa, Schwab, and Johnson, 1999).

The National Staff Development Council (NSDC, 2001) recommends that faculty members learn to work collaboratively to make decisions and solve problems. Additionally, it is recommended that staff development focus on an integrated approach to thinking and learning. Various models of collaborative staff development have been found to be effective. Professional Dialogue is a model that can be implemented with a small group of teachers meeting regularly to discuss their teaching as it relates to current trends in education (Glatthorn, 1987). Curriculum Development is another model in which teachers analyze, adapt, and improve the curriculum based on current research. Peer Supervision and Peer Coaching models are both collaborative methods in which teachers observe each other and provide feedback (Glatthorn, 1987). Similarly, mentoring models of collaborative staff development encourage teachers to work together to improve practice for both the mentor and mentee (Healy and Welchert, 1990). Research on this type of staff development has found that teachers participating in collegial mentoring programs continued to grow professionally throughout the mentoring experience. Furthermore, a strong professional community has been found to improve the classroom environment and improve student achievement (Louis and Marks, 1998). This collaboration should extend beyond the training and planning aspects directly into teaching. In a Collaborative Teaching model teachers have a partner in all aspects of instruction. They have a shared time block in which to plan, and a shared group of students. This takes a lot of pressure off one teacher, and allows each teacher to use his or her strengths to benefit the students (McQueen, 2001).

Specifically in the area of technology, peer observation and coaching are recommended to help teachers to integrate technology into their teaching. Additionally, regular meeting are recommended to give teachers an opportunity to share progress and concerns (Brand, 1998). Teachers must also be given options and flexible scheduling in their staff development, and there must be continuity in time periods of the staff development sessions (Bailey and Pownell, 1998). Teaming is a very important component in staff development. Teaming allows teachers to plan together and move forward in their use of technology together taking pressure off individuals (Bailey and Pownell, 1998). Furthermore, Schwab and Foa found that evaluation equals excellence (2001) and that continuous evaluation through observation helped to sustain the effectiveness of the technology staff development program.

Also, a variety of assessment methods are needed to assess staff development, (Milone, 1999; Bailey and Pownell, 1998). Planning staff development based on assessed needs, research shows, gives participants a sense of ownership because they feel that the training is responsive to their needs (Knapczyk, et. al., 1991).

Finally, training must focus on the integration of technology and not simply training in technology skills. A recent study found that teachers needed training specifically in using technology with students and in conjunction with the other subject areas (Schwab and Foa, 2001). Further research shows that even teachers who are proficient in using technology are not able to integrate it into instruction effectively without training specific to integration (Vojtek and Vojtek, 1999).

Teacher Attitudes toward Technology

One roadblock to widespread technology use in teaching has been teachers' apprehensive attitude toward technology. Teachers are both skeptical and fearful of using technology in the classroom (Albaugh, 1997). According to Albaugh (1997) skepticism is more easily addressed than fear. By definition, skepticism is a healthy investigation and research into the unfamiliar, while fear is a “hardening” of attitudes that is difficult to overcome. Computer anxiety, or fear of computers, is prevalent in both pre-service and in-service teachers, however. Not suprisingly, computer experience is negatively related to computer anxiety (Benson, 2001). In other words, if teachers are given more experiences with computers their comfort level increases, and the fear diminishes.

There are several types of people involved in any change. Early adopters approach the change enthusiastically, and fully implement changes. Skeptics want more information and implement slowly. Resistors fight against the change. The negative attitude that some teachers have toward technology can be understood through the life cycle of innovations in education (Albaugh, 1997). “Innovations typically have a birth, used in light of current ideas, they die from a lack of interest or innovative application, and then they are resurrected in a new form.” (p.4) (Albaugh, 1997). Many teachers view technology as a current fad and do not see the need to put time and effort into an area that will soon be gone. Furthermore, they may consider current methods to be equal to or better than using technology to teach. Many teachers prefer to use the textbook and previously used materials, to learning and implementing new software (Marshall, 1995). In the past this lack of use has been addressed by providing funding, or explained by a lack of funding, but what is actually needed is training (Marshall, 1995).

Teachers also may be reticent to integrate computers into their teaching due to a feeling of overload (Pisipia, Coukos, and Knutson, 2000). In a study of a computer initiative in which elementary school teachers were provided computers and training on specific software, the feeling of overload was a recurrent theme in interviews with both classroom teachers and technology instructors. Many from both groups expressed feeling overloaded by state and district requirements to integrate computers into their teaching, and several also expressed concerns over simply meeting minimum curricular requirements with their students. Participants felt that they did not have the time to learn and implement new software on top of meeting those requirements. Surprisingly, teachers in this study expressed a desire to implement technology and saw it as a needed addition to their curriculum, however teachers at all levels of technology proficiency found it difficult to find time to integrate technology. This study found, however, that after three years of the initiative seventy-seven percent of the teachers expressed that they were "capable of infusing technology into their instruction" (p.12) as opposed to twelve percent before the initiative began (Pisipia, Coukos, and Knutson, 2000).

Integrating Computers into the Curriculum

Technology integration is an expanded view of technology as a process, product, and tool to find solutions to authentic problems, communicate results, and retrieve information (Moersch, 1994). When technology is effectively integrated into the curriculum it is blended or evenly distributed in the curriculum. Students learn the core curriculum and use technology to help them learn efficiently (Vojtek and Vojtek, 1999). Traditional curricula is usually disconnected from students and segmented. It can also become outdated quickly, particularly with eight to ten year old textbooks found in some schools, and is not as individualized as it should be . Using current technology, and particularly the internet, can individualize learning and keep the curriculum up to date (Land, 1997).

According to the Level of Technology Implementation (LoTi) scale (Moersch, 1995), there are six stages of development which teachers go through in moving toward teaching with integrated technology. The lowest level of implementation is Non-Use. At this level there is a perceived lack of access to technology, a lack of time to integrate technology, and the technology that is used is primarily text-based. In the classroom of a teacher at this level one would not see any evidence of computer use.

The next level is Awareness. At the Awareness level, technology may be implemented, but by someone besides the classroom teacher, such as in a lab or pull-out program. Technology may be used by the teacher, but only for classroom management tasks such as grading, or to enhance teacher-directed lessons; therefore, one might observe computer use in the classroom of a teacher at this level, but only for teacher productivity. Curriculum Management tools may also be used to generate standards-driven lesson plans.

The third stage toward full integration is Exploration. The Exploration stage is characterized by the use of technology based tools, such as games or basic skills application to supplement the instructional program, at the knowledge/comprehension level. The technology is used for extension or enrichment activities or to reinforce lower cognitive skill development. In the classroom of a teacher at the Exploration level one might observe student projects where the emphasis is on the technology rather than the content, or the computer may serve as a reward or a review station.

The next stage is the Infusion stage. At the Infusion stage, technology based tools such as databases, spreadsheets, multimedia, desktop publishing, and the Internet are used to complement instruction. These activities are used at the analysis, synthesis, and evaluation levels. Emphasis is placed on higher level thinking and in-depth study of a topic. When observing in a classroom of a teacher at this level, one might see student use of applications such as databases and spreadsheets for making inferences and drawing conclusions. Students are engaged in a variety of inquiry based projects and then they share the results of their work on a webpage or multimedia presentation.

Next teachers reach a level of integration which has two stages. The first is mechanical integration where technology-based tools are integrated in a mechanical way which provides rich context for students. Pre-packaged materials and outside resources are relied on heavily. Technology is used as a tool to solve authentic problems and as part of an overall theme or concept. Resolving problems using high levels of cognitive processes is emphasized to examine the content in depth. In this type of classroom one might observe students developing authentic projects such as a kiosk for the school to provide safety information to students, or organizing a school fund raiser to raise money to contribute to an environmental cause based on experimentation and research.

Although teachers are integrating technology at this level, teachers at the next stage of this level are able to integrate at a less mechanical level. This level is Routine Integration, and is characterized by teachers readily designing and implementing units which allow students to solve authentic problems using the available technology with little or no outside assistance. Student action and issue resolution are emphasized requiring students to use higher level thinking skills for an in-depth examination of the content. When observing students in a class where the teacher is at the Routine Integration one would see students using all available resources, including technology to solve problems in their own environment, such as a multimedia presentation highlighting inconsistencies among several history texts, or a website which provides ongoing interaction regarding possible solutions to a community problem.

Although teachers who are offering instruction at either the mechanical or routine levels of technology integration are offering their students a rich environment in which they are employing higher order thinking skills and are operating at a high cognitive level, there is still room for further growth for the teachers. After teachers reach the level of Routine Integration they can move beyond that to Expansion. Teachers at the Expansion level extend the use of technology beyond the classroom by actively eliciting technology applications and networking with other schools, businesses, government agencies, research institutions, and others to expand student problem solving experiences and encourage student activism. Products from the classroom of a teacher at this level of technology integration might be an online business venture reflecting the culmination of a marketing class, or a project using a variety of multimedia tools in which students help a traveler accomplish the goal of biking across the US by providing daily weather and terrain reports through a mobile communication device.

Finally, teachers may reach the level of Refinement. At this highest level, technology is a process, product, or tool for students to find solutions to problems of issues in their world. There is no longer a division between technology and instruction, and students have access to and understanding of a wide variety of technology. The curriculum is completely learner-driven, and the content is developed as the needs of the student develop. In this classroom, students might develop an interactive website for bilingual students, or develop new home designs with sophisticated software.

An integrated technology based curriculum results in many positive student outcomes. Some of these are intrinsic motivation of students and greater student control over learning because they can be given choices and guide their own learning. When using technology students abilities are equalized because they can pursue information and projects at their own level and pace, and the teacher has more freedom to assist those who need more guidance. Students can be more productive as keyboarding and technology skills develop, because, again, there is less time spent waiting for the class to move at the same pace. Quality of work becomes more important to students as they use technology to communicate with others inside and outside of the school, and they present their work (Hunter, Bagley, and Bagley, 1993). Additionally, using the Internet may increase attention that students are willing to commit to a task. Students may perceive information on the Internet to be more relevant to them because students have more control over their learning, and may have a higher degree of satisfaction with learning when it is self directed, current and integrated (Land, 1997).

Teaching with integrated technology is also a way to enhance higher level thinking skills (Moersch, 1998). Model schools in technology integration achieve this by using computers as a tool to provide real world experience, allowing students to participate in inquiry, and seek out answers to their questions, and work collaboratively with others within the school, and outside of the school. Effective technology integration can “improve communication and individualization” and allow us to “hear more voices and reach more listeners” (Moran and Payne, 1998). However, to achieve to potential that technology integration offers, teachers must be effectively prepared.

As was discussed previously, often teacher training in technology is focused on skills instead of integration. The result of training teacher in isolated skills instead of computer use in teaching, is that even the most computer proficient teachers are not able to pass these skills on to students, and they are not able to implement technology in an integrated way (Vojtek and Vojtek, 1999). “At best, teachers develop project-based learning opportunities for students that are applied rather than integrated.” (p.67). Educators must strive for integration rather than application. Furthermore, they must be able to determine the best technological tool to effectively integrate (Vojtek and Vojtek, 1999). Teachers cannot simply be trained to use computers, the must be trained specifically in using technology within their curriculum. Without training in curriculum integration, teachers will bounce from skill to skill, unable to bring technology into the curriculum(Foa, Schwab, and Johnson, 1999).

Curricular Change

The standards of the National Staff Development Council indicate that effective staff development is "an innovation in itself which requires study of the change process" (Zepeda, 1999). Even a well-planned and researched instructional strategy, such as integration of computers into the curriculum cannot be effectively implemented unless teachers' needs through the change process are understood and addressed.

Many ecological and cultural factors within the school effect change. The ecological factors that effect change are physical surroundings and structures, formal policies and rules, and resources. Three cultural factors which effect curricular change. These factors are attitudes and beliefs, norms, and relationships (Boyd, 1992). These cultural factors are discussed repeatedly in the literature on change Deal (1985) reported that "School leaders seeking to shape the culture must first understand the present culture of the school." (p.601). School culture can indicate whether a school is moving, sinking, struggling, or cruising, (Stoll and Fink, 1996). A moving school is effective and improving; a cruising school is effective and declining; a struggling school is ineffective but improving, and a sinking school is ineffective and declining (Stoll and Fink, 1996). The state of the culture can greatly influence the implementation of a new program, while the effectiveness of training and follow-up for an innovation can greatly affect the school culture. School personnel have a "conception of a school which, if subject to change or challenged, they strongly defend" (p.75) (Sarason, 1995). Those attempting to make changes within a school, or to the school culture, must be aware of these perceptions and work with them for effective change.

Relationships play possibly the most significant role in any change. Sarason (1995) discusses the complex relationships among teachers and claims that these relationships are "of crucial importance" (p. 73). Often, one key person in support of a change can sway a formerly reticent staff (Mendez-Morse, 1993). Within this stage key individuals (teachers, not specialized personnel) can be identified, and given time to model effective implementation (Foa, Schwab, and Johnson, 1999). It is important to involve a leader or leadership team to help keep the lines of communication open from administration to staff (Mendez-Morse, 1993; Mahaffey,1988), and teachers may feel more comfortable working with their peers to implement new classroom management strategies.

Throughout the implementation of a new program, administrators, specialized personnel, and leaders must be vigilant in assessing conflicts and concerns (SEDL, Spring 92; Fullen and Miles, 1992). These bumps along the road of the implementation of change can send the culture and norms back to a place where the innovation is rejected due to the intricate network of relationships that can work like a tide toward and away from change. For this reason it is imperative to be aware of conflicts and concerns and address them as they arise.

Teachers involved in a change go through several Stages of Concern (Hord, 1985, 1992; Hall and Hord, 1987; Hord, Rutherford, Huling-Austin, and Hall,1998), and have different needs at each stage. The initial Stage of Concern is awareness in which the teacher is either not aware or not concerned about the change. In this stage the teacher needs encouragement and/or information from colleagues and administrators about the necessity of the change. Next is the informational stage in which the teacher would like to know more. In this stage the teacher should be offered resources to provide information, such as literature and workshops. The next stage is the personal stage in which the teacher wants to know how it is going to affect them. Teachers in this stage should be given support in implementing changes, and provided information on the positive impacts on them personally that come with the change. Next is the management stage, during which teachers are concerned about gathering materials, organizing their time, and using the innovation effectively. This stage is crucial because it is the easiest one for teachers to become bogged down in, and the may regress in implementation, if they do not fell that they can manage the change. Teachers in the phase can be helped greatly by teaming and collaborative approaches as discussed in the other sections. By working together, the pressure of managing the change is divided among several people. Next is the consequence stage in which teachers want to know how the innovation affects their students. Data is an important component of this stage. Assessment of the innovation should be built in to the change and teachers should be able to use the assessment data to determine the affect on students, and make adjustments based on the data. Next teachers go through the collaboration stage in which they wonder how others are implementing the change. As previously discussed, the most effective changes integrate collaboration throughout the implementation of a change. The final stage that teachers will reach is the refocusing stage, in which teachers have ideas for improving the innovation. Again, collaboration and a strong school culture are very important, because teachers working in a collaborative positive environment can work together to offer and implement changes. (Hord, 1985, 1992; Hall and Hord, 1987; Hord, Rutherford, Huling-Austin, and Hall,1998).

Summary

Technology is used most effectively when teachers reach the highest levels technology integration. Integration results in authentic, inquiry-based learning for students. There are several obstacles to achieving a curriculum in which technology is fully integration. Some of these obstacles are teachers' fear of technology, lack of technological knowledge, and fear of change. These concerns must be addressed by providing a collaborative environment in which teachers are able to share their concerns and accomplishments with colleagues, and teachers work together to move forward in the use of technology. This can be achieved through collaborative training methods. Using methods in which teachers are trained to interact and encouraged to work as a team, they will better be able to face the changes in teaching methods that are called for with the introduction of computers into the schools. Furthermore, the training must specifically address methods in integrating technology into the curriculum, not only in computer skills.

CHAPTER 3

METHODS AND PROCEDURES

Sample

Twenty-three teachers from one elementary school participated in the study. Nine participants were assigned to the control group. Fourteen participants were assigned to the experimental group. Names of participants were randomly drawn to determine group assignment. Participants in the experimental group chose a partner, with whom they worked in all three staff development sessions. Twenty of the participants were female, three of the participants were male, and all were white. The participants ranged in experience from one semester of experience to thirty years of teaching experience. The school is a small suburban school with an enrollment of two hundred eighty nine students.

Instrument

Participants submitted a lesson plan at the beginning of the study which was rated on the Level of Technology Implementation (LoTi) scale (Moersch, 1995) as outlined on the State of Georgia Instructional Technology Implementation Observation (Moersch, 2001) by three independent raters prior to the training. Only the checklist portion of this instrument was used by the raters. This scale has a range of zero (Non-Use) to six (Refinement). The three ratings for each participant were added together for a scale of zero to eighteen.

The three raters were trained to use the State of Georgia Instructional Technology Implementation Observation checklist (Moersch, 2001) to determine the LoTi of each lesson plan submitted by the participants. First, the raters were given the same description of the Levels of Technology Implementation as the participants were given to use as a guide. Next, the researcher provided a sample lesson, and the raters were shown how to look for items on the checklist that described the use of technology in the lesson. Then, after the items that were applicable to the sample lesson were checked off, the Level of Technology Implementation where the greatest numbers of descriptors matched as checked off by the rater was determined to be the Level of Technology Implementation for that particular lesson. Raters completed two ratings of sample lessons with the researcher, and then they rated one lesson without the guidance of the researcher and discussed their assessment of the lesson. Finally, each rater rated ten lessons developed by the researcher based on sample lessons provided by the author of the instrument (Moersch, 1995). On these ten sample lessons, the inter-rater reliability was .9119 across the three raters and this correlation was statistically significant at the .001 level. This result indicates strong reliability of the data. The correlation of the ratings of the three raters and the expert was .95. This indicates a very strong correlation.

Following the staff development sessions each participant or group of cooperatively trained participants submitted a lesson plan which was also rated based on descriptions of the uses of technology at each Level on the LoTi scale (Moersch, 2001). These lesson plans were also rated by three independent raters. These scores were also added together for a total score of zero to eighteen. The initial ratings were then compared to the ratings following the training using a mixed model two by two ANOVA.

Results of Analysis of Inter-Rater Reliability

Three raters were trained to use the State of Georgia Instructional Technology Implementation Observation checklist (Moersch, 2001) to determine the Level of Technology Implementation of each lesson plan submitted by the participants. First, the raters were given the same description of the Levels of Technology Implementation as the participants were given to use as a guide. Next, the researcher provided a sample lesson, and the raters were shown how to look for items on the checklist that described the use of technology in the lesson. Then, after the items that were applicable to the sample lesson were checked off, the Level of Technology Implementation where the greatest numbers of descriptors matched as checked off by the rater was determined to be the Level of Technology Implementation for that particular lesson. Raters completed two ratings of sample lessons with the researcher, and then they rated one lesson without the guidance of the researcher and discussed their assessment of the lesson. Finally, each rater rated ten lessons developed by the researcher based on sample lessons provided by the author of the instrument (Moersch, 1995). On these ten sample lessons, the inter-rater reliability was .9119 across the three raters and this correlation was statistically significant at the .001 level. This result indicates strong reliability of the data.

The correlation between raters was also strong, but not as strong as the correlation between all raters. The correlation between rater one and rater two was .63. The correlation between rater one and three was .88, and the correlation between rater two and rater three was .81. These data indicate that the combined ratings of all three raters yield greater reliability than the ratings of any two raters.

Table 1

Correlation Matrix for Sample Lesson Ratings

	Rater 1	Rater 2	Rater 3
Rater 1	1.000		
Rater 2	.6299	1.000	
Rater 3	.8813	.8129	1.000

The concurrent validity coefficient for the sum of three raters correlated with the "expert" was .954. This indicates strong validity of the Levels of Technology Implementation instrument. These results indicated that the raters were prepared to assess the lesson plans submitted by the participants.

Design of the Study

The sample was the entire population yielding a true experimental design with a pretest post test control group design. Participants were randomly assigned to groups. The independent variables in this study were occasion and group. The occasion variable was a comparison of the pretest and the post teat scores. The group variable was a comparison of the participants who worked cooperatively and those who worked individually. The dependent variable was the score on the State of Georgia Instructional Technology Implementation Observation (Moersch, 2001).

Data Collection

Over a period of one semester, teachers attended three staff development sessions. These sessions will focused on familiarizing teachers with the Technology Applications TEKS and integrating these required skills with the topics taught in the other curricular areas, specifically focusing on math, science, English language arts, and social studies. Prior to participation in the sessions three raters rated the current Level of Technology Implementation for each of the participants on a scale of zero for Non-Use up to six for the highest level of technology integration based on a lesson plan submitted by the participants. The participants in the control group submitted one lesson plan for each individual. The participants in the experimental group submitted one lesson plan for the team of two. The sum of these three ratings were the participants' pre-test score.

After the pre-test score was established, participants attended three technology staff development sessions. During the first session two approaches to using the internet in the classroom were discussed. The first was using a computer center to address a certain topic. In this case it was recommended that teachers narrow the scope for students to two to four websites depending on age, and provide a guide or response sheet to focus students on the topic.

At the second training different ways to meet specific TAAS Objectives with technology, such as using websites to practice summarization, and using spreadsheets to convert tallying to graphs, were demonstrated, allowing differentiation to meet student needs. Various organizational techniques were discussed such as focusing on a certain objective and building a lesson or center activity around it, or starting with a theme and then addressing TAAS objectives within the theme. Use of search engines appropriate for children and using technology in centers were reviewed from Session 1.

At the third session participants were introduced to the LoTi scale(Moersch, 1995). After the levels of the scale were described, participants brainstormed integration projects in various subject areas, and began planning lessons with integrated technology.

Following these three sessions participants in this group submitted a lesson plan written individually. These lesson plans were given a rating based on the Level of Technology Implementation Scale (Moersch, 1995) as outlined in the Instructional Technology Implementation Observation (Moersch, 2001) by each of the three raters. These three scores were added together, and the sum of the three ratings was the post-test score. The difference indicated the amount of growth by the participants during the semester of participation in the training sessions.

The experimental group participated in staff development sessions covering the same topics as the sessions presented to those in the control group. The participants in the experimental group, however, were encouraged and given opportunities to discuss ideas and work with their partner during the sessions. They develop a lesson plan with a partner that was rated for the post-test score.

The three raters were then trained in using the instrument to analyze the lesson plans. During the training sessions the raters will rate three lessons with the help of the trainer. Then they will rate ten lessons individually. These ratings will be analyzed to establish inter-rater reliability.

The pre and post scores for both the experimental and the control groups were then analyzed to determine whether growth has occurred over the semester in which the teachers participated in the training sessions. The results were further analyzed to determine if there was a difference in the growth of those who worked individually during the training sessions and those who worked cooperatively.

Data Analysis

Prior to the training sessions, each participant, or pair of participants submitted a lesson plan describing a lesson that they have previously used in their classroom. These lesson plans were rated by three independent raters using the LoTi scale. The initial ratings of the three independent raters were added together giving each participant a possible score of zero to eighteen. Zero will indicate that the participant is at the Non-Use stage of technology integration, and sixteen to eighteen will indicate that the participant is at the highest level of technology integration. This is a quasi-interval scale.

Following three training sessions each participant, or cooperative group of participants, submitted two lesson plans. These plans were used to rate the participants on their level of technology integration, again on a scale of zero to eighteen. The first set of ratings were then compared to the second set of ratings using a mixed model, two by two ANOVA, grouped by occasion with repeated measures on occasion. The results of this analysis will be used to detect upward movement on the Levels of Technology Implementation (Moersch, 1995) scale by the participants during the semester in which they participate in the staff development sessions. The change in ability to integrate technology by the control group, as indicated by the lesson plans, was compared to the growth of those in the experimental group.

CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

The null hypotheses addressed by this study were that there is no statistically significant difference between occasion one (the pre-training lesson plans of teachers trained either individually or cooperatively in technology integration) and occasion two (the post-training lesson plans of teachers trained either individually or cooperatively in technology integration) and there is no statistically significant difference for the interaction between group assignment (individual technology integration training versus cooperative technology integration training) and the occasion (pre- versus post-technology integration training). These hypotheses were explored by comparing staff development methods to determine whether a cooperative model of staff development is more effective than individual training in helping teachers learn to develop lessons in which they integrate technology with the other curricular areas.

Twenty three teachers participated in three staff development sessions focusing on integrating technology with the other content areas. The topic of the first session was using the Internet in instruction. The topic of the second session was addressing the TAAS objectives with technology. The topic of the third session was developing integrated lesson plans. Prior to attending these sessions participants submitted lesson plans which they had previously used in their classrooms. Following the sessions, they, again submitted lessons. Those in the control group worked individually to develop these lessons, while those in the experimental group worked with a partner. The lessons were rated by three raters using the State of Georgia Instructional Technology Implementation Observation (Moersch, 2001) checklist. Two participants in the control group did not submit second lesson plans; therefore, those two participants were not included in the data analysis.

This chapter addresses the results of the inter-rater reliability and validity analysis of the initial ten lesson plans rated by each rater and the researcher, considered the expert for this analysis. It also considers the results of the mixed model, two-by-two ANOVA, grouped by occasion with repeated measures on occasion used to assess the ability of participants to plan lesson with integrated technology following the three training sessions.

Results of Analysis of Participants' Lesson Plans

The ratings of the lesson plans collected from participants before and after the training sessions were analyzed for inter-rater reliability. On these lessons the inter-rater reliability was .9194 across the three raters and this correlation was statistically significant at the .01 level. This inter-reliability was higher than the inter-rater reliability from the initial data and indicates strong reliability of the data. The correlation between raters was, again, also strong, but not as strong as the correlation between all raters. For these sets of lesson plans the correlation between rater one and two was .84, the correlation between rater one and rater three was .89, and the correlation between raters two and three was .74. Again the correlation between all three raters was stronger than that of any two raters.

Table 2

Correlation Matrix for Participant Lesson Ratings

	Rater 1	Rater 2	Rater 3
Rater 1	1.000		
Rater 2	.8386	1.000	
Rater 3	.8868	.7376	1.000

Effects of Occasion, Group and Interaction Variables

The first set of ratings were compared to the second set of ratings using a mixed model, two-by-two ANOVA, grouped by occasion with repeated measures on occasion. The results of this analysis were used to detect upward movement on the Levels of Technology Integration (Moersch, 1995) scale by the participants during the semester in which they participated in the staff development sessions. The change in ability to integrate technology by the control group, as indicated by the lesson plans, was compared to the growth of those in the experimental group.

Table 3

Two-by-Two ANOVA of the Pre- and Post-training Lesson Plans (Occasion) and Interaction Effect of Group with Occasion

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Occasion	89.286	1	89.286	35.047	<.001	.745
Occasion*Group	5.143	1	5.143	2.019	<.1	.144
Error (Occasion)	30.571	12	2.548			

For this particular analysis, the occasion variable is the variable that indicates the change from pre test, (i.e. the lesson plans submitted prior to the training sessions), to post test, (i.e. the lesson plans submitted following the training sessions). The group variable is the variable that indicates whether the participant was in the control or experimental group.

The F score of 35.047 for occasion indicates that the results were statistically significant at the .001 level; therefore, the null hypothesis that there is no statistically significant difference between occasion one (the pre-training lesson plans of teachers trained either individually or cooperatively in technology integration) and occasion two (the post-training lesson plans of teachers trained either individually or cooperatively in technology integration) was rejected in this case. The Eta squared score of .745 indicated a very strong effect size for the occasion variable.

The interaction between occasion and group had an F score of 2.019. This result was statistically significant at the .1 level; therefore, the null hypothesis that there is no statistically significant difference for the interaction between group assignment (individual technology integration training versus cooperative technology integration training) and the occasion (pre- versus post-technology integration training) was rejected. The effect size for the interaction of occasion and group is very small, however. The Eta squared for the interaction effect was .14 which is a minimal effect size.

Table 4

ANOVA for Group Variable

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Intercept	1235.571	1	1235.571	183.371	<.001	.939
Group	36.571	1	36.571	5.428	<.01	.311
Error (Occasion)	80.857	12	6.738			

The group variable indicates whether participants were in the control group or the experimental group. The F score for the group variable was 5.428. This result was statistically significant at the .01 level therefore the null hypothesis that there is no statistically significant difference between group one (the control group) and group two (the experimental) group was rejected, at least initially. The Eta squared for the group variable is .311 This is a moderate effect size.

Analysis of Mean Scores

Additionally, mean scores for each group at each occasion were calculated and plotted on a graph.

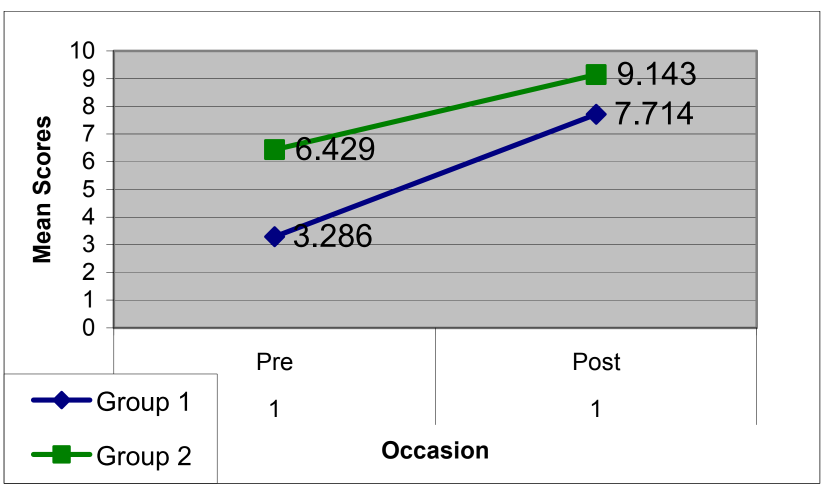
Table 5

Mean Scores for Each Group of Pre- and Post Lesson Plans Scores

Group	Occasion	Mean	Std. Error
1 (Control)	Pre	3.286	.907
	Post	7.714	.710
2 (Experimental)	Pre	6.429	.907
	Post	9.143	.710

Table 6

Graph of Mean Scores of Each Group on Each Occasion



As the table and the graph indicate, the mean scores of those in the experimental group (those working with a partner on the initial lesson plans) was 6.43 which was higher than the 3.29 mean score of the control group (those working individually). The mean score of 9.14

scored by those in the experimental group was higher than the 7.71 mean score by participants in the control group on the lesson plans submitted following the training sessions also. The increase in mean score, however, was greater for those in the control group; therefore, the margin between the first occasion mean scores was greater than the margin between second occasion mean scores. This indicates that, while the null was rejected the actual effect of working with a partner is minimal.

CHAPTER 5

DISCUSSION

The purpose of this study was to compare staff development methods to determine whether a cooperative model of staff development was more effective than individual training in helping teachers learn to develop lessons in which they integrate technology with the other curricular areas. The null hypotheses were (1)there is no statistically significant difference between occasion one (the pre-training lesson plans of teachers trained either individually or cooperatively in technology integration) and occasion two (the post-training lesson plans of teachers trained either individually or cooperatively in technology integration). (2)there is no statistically significant difference for the interaction between group assignment (individual technology integration training versus cooperative technology integration training) and the occasion (pre- versus post-technology integration training).

To explore these hypotheses, twenty three teachers participated in three staff development sessions focusing on integrating technology with the other content areas. The topic of the first session was using the internet in instruction. The topic of the second session was addressing the TAAS objectives with technology. The topic of the third session was developing integrated lesson plans.

Before attending the training sessions, each participant submitted a lesson plan in which technology was integrated with another curricular area. The technology could have been used in either the instructional or assessment portion of the lesson. Following the three sessions, the participants again submitted lesson plans in which technology was integrated with another subject area. Each of these lesson plans was rated by three raters using the Instructional Technology Implementation Observation checklist (Moersch, 2001), which has a quasi-interval scale of zero to six. This instrument measures the Level of Technology Implementation (LoTi) (Moersch, 1995) of each participant or partnership as indicated by the lesson plan submitted.

Level zero on the LoTi scale is non-use. Teachers at this level may perceive a lack of access to technology and a lack of time to integrate technology. The technology that is used by teachers at this level is primarily text-based. Level one is awareness. At the awareness level, technology may be implemented, but it is done by someone besides the classroom teacher, for instance in a lab or pull-out program. Technology may be used by the teacher, but only for classroom management tasks, such as grading, or to enhance teacher-directed lessons. Level two is exploration. At the exploration level, the technology is used for extension or enrichment activities, or to reinforce lower cognitive skill development. Level three is the infusion stage. At the infusion stage, technology based tools such as databases, spreadsheets, multimedia, desktop publishing, and the Internet are used to complement instruction. At this level, activities are teacher-centered and teacher-directed. Level four is integration and has two stages. The first stage is mechanical integration. At this level, technology-based tools are integrated in a mechanical way, which provides a rich context for students. Pre-packaged materials and outside resources are relied on heavily. Activities at this level are student-centered. Also at level four is routine integration, which is characterized by teachers readily designing and implementing units which allow students to solve authentic problems using the available technology with little or no outside assistance. Student action and issue resolution are emphasized, requiring students to use higher level thinking skills for an in-depth examination of the content. Level five is the expansion level. At this level, teachers extend the use of technology beyond the classroom by actively eliciting technology applications and networking with other schools, businesses, government agencies, research institutions, and others to expand student problem solving experiences and encourage student activism. At level six, teachers may reach the level of refinement. At this level, technology is a process, product, or tool for students to find solutions to problems of issues in their world. There is no longer a division between technology and instruction, and students have access to and understanding of a wide variety of technology. The curriculum is completely learner-driven, and the content is developed as the needs of the student develop. The raters were trained to use the State of Georgia Instructional Technology Implementation Observation checklist (Moersch, 2001) to indicate the level at which each participant or partnership was able to plan lessons using technology. The raters then rated ten sample lessons to establish inter-rater reliability. The ratings by each of the raters was added together to create a quasi-interval scale of zero to eighteen.

In this chapter, the findings from the study are discussed. The research methodology is critiqued and suggestions are made for future research

Findings and Critique of Study

This instrument had not been used before in this way; therefore, inter-rater reliability was established prior to the analysis of the study data and then again with the study data. Prior to rating the lesson plans submitted by the participants, each of the three raters rated ten sample lesson plans created by the researcher, considered the expert for the purpose of this analysis, based on lesson suggestions by the author of the instrument. The ratings of the three raters and expert had a strong, positive correlation ($r = .95$), which indicates strong concurrent validity of the instrument. Additionally the inter-rater reliability correlation coefficient was .91. This indicates strong inter-rater reliability. This scores indicated that the raters were prepared to rate the lesson plans submitted by participants without further training on the instrument.

The inter-rater reliability on the lessons submitted by participants was .92; also indicating very high inter-rater reliability. Additionally, the correlations between raters were also lower than the correlation of all raters, indicating that including all three raters yielded the highest inter-rater reliability.

With regard to the null hypotheses: teachers who have the opportunity to discuss, brainstorm, and develop lesson plans with a partner can more effectively develop lessons with integrated technology than those who participate in staff development and write lesson plans alone and teachers who are trained to integrate technology will improve in their ability to write lesson plans with integrated technology; the results of the ANOVA indicate that there was a statistically significant result for the group variable, for the occasion variable, and for the interaction of the two. The effect sizes as indicated by the Eta-squared, however, give a much better picture of what actually occurred in this study.

The effect size for the occasion variable was .745. This indicates that the independent variable, the lesson plan score, strongly affected the dependent variable score, occasion. In other words, the training strongly effected a positive change in the score from the first lesson plan to the second lesson plan in both groups.

The effect size for group, however, was much smaller than the effect size for occasion. The group effect size as indicated by the eta-squared score was .311. This is a moderate effect size, which indicates that there was some effect of the dependent variable, group, on the independent variable, the lesson plan score. The control group, the group that worked individually, overall, scored lower on the initial lesson plans than the experimental group, those that worked cooperatively with a partner. Since those in the experimental group submitted only one lesson plan for the pair, these results may be an indication that the initial scores were actually measuring the level of the partner at the higher level on the Level of Technology Implementation (LoTi) scale (Moersch, 1995). The beginning mean score for the control group was 3.29, with two participants scoring zero, which indicates that they were at the non-use level. These two participants submitted lesson plans which the raters indicated contained no use of technology. Since the ratings of the three raters were added together, the mean score just over three indicates that the mean Level of Technology Implementation for the control group was the awareness stage.

The experimental group mean on the initial lesson plans was 6.43. This mean score indicates a beginning mean Level of Technology Implementation at the Exploration level. This mean is one level ahead of those in the control group. Since each pair of participants submitted only one lesson plan, this score on the LoTi scale could be a reflection of the level of the more proficient partner.

A better study design would have been to measure each partner's individual beginning scores and then compare that to individual scores following the staff development. This might have yielded more accurate information regarding the starting point of each participant, and might have also provided some information on whether each partner in the experimental group showed improvement on his or her LoTi score. With the current study design, both the participants working with a partner and the participants working individually appeared to show an increase in their LoTi score. Additionally, this study could have been improved by using matching to create the groups to insure that the groups were appropriately similar for comparison.

The interaction effect most directly addresses the research hypothsis, teachers who have the opportunity to discuss, brainstorm, and develop lesson plans with a partner can more effectively develop lessons with integrated technology than those who participate in staff development and write lesson plans alone. The effect size for the interaction was smaller than the effect size for the dependent variable group, and the effect size for the dependent variable occasion. The interaction effect size was .14, which indicates a minimal effect. In other words, the interaction of group with occasion has little effect on the independent variable, the score on the LoTi scale, therefore the hypothesis was rejected.

These data suggest that participating in training and then developing lesson plans with a partner does not lead to more effective lesson planning than participating in the training and then developing lesson plans individually. These data, do suggest, however, that training focused specifically on integrating technology can help teachers to plan lesson at a higher level of technology implementation, regardless of whether the work individually or cooperatively.

Implications for Practice

These findings have significant implications for training teachers to effectively integrate technology with the other content areas. The strong validity and reliability scores indicate that this instrument is effective in measuring the Level of Technology Implementation of teachers. This instrument can be used for assessing written lesson plans as was done in this study, or as an observation instrument for assessing lessons. Determining the Level of Technology Implementation can then guide the development of training sessions for teachers at various levels. Additionally, an awareness of a teacher's LoTi level can be used for effective mentoring of the teacher to assist in their progress up the LoTi scale.

In this study, participants in the control group had a mean score of 7.71 at post test. This indicates a mean between level two, the exploration stage, and level three, the infusion stage. On average, teachers in this group moved from a level of technology implementation in which they are just becoming aware of using technology in instruction, up one to one and a half levels to a level where they are able to direct whole-class lessons in which technology is used to teach content. With this information, the trainer would then be able to focus training toward more student-centered use of technology to help these teachers move fully into the infusion stage, and then into the integration stage.

Those in the experimental group had a mean of level three on the LoTi scale at post test. On average, participants in this group were able to plan lessons with their partners at the infusion level. They also went up one to one and a half levels. The next phase of training for this group would be to take a more constructivist approach to addressing content with technology, and to take a more student-centered approach.

While the experimental group mean score placed them in the infusion stage, and the control group was, on average between the exploration and infusion stage, the levels as indicated by the post test scores were very similar in that they were at the same level. This similarity could indicate that the training sessions primarily trained teachers to develop lessons with integrated technology at the infusion level. At the training sessions, participants were introduced to all levels on the LoTi, and were guided toward lesson development at all levels. Participants in the change process, however, adapt to change best when they are able to move through the levels of change at a comfortable pace (Hord, 1985, 1992; Hall and Hord, 1987; Hord, Rutherford, Huling-Austin, and Hall,1998). Since these training sessions took place over one semester, the ability of the participants to plan lessons one to two levels higher than they were able to prior to the sessions is a positive step toward becoming more proficient in the use of technology with other content areas. If they are to become proficient in planning and implementing lessons at higher levels on the LoTi scale, it is important to be aware of their current level, create training sessions specifically addressing technology use at the next level, and provide the time and support to practice using technology at the next level.

Recommendations for Future Research

There are several recommendations for future research based on these findings. It would be valuable to replicate this study with a much larger sample size. Although this study did not indicate that a collaborative approach was no more effective than an individual approach, both groups did show growth in the ability to plan lessons with integrated technology. An exploration of (1) participants' preferences of whether to work with a partner or individually and (2) level of morale or positive attitude when working with a partner as opposed to working individually might be useful. A study of these preferences in relation to the learning style or personality of the teacher might also be useful in understanding effective training methods.

Staff development models in which integration of technology with other curricular areas, rather than training focused only on increasing technology skills, are needed. While integration of technology is becoming a common topic in professional literature and among practitioners, there are very few research-based staff development models for training teachers to integrate technology with the curriculum.

These findings support previous findings (Schwab and Foa, 2001) in that they indicate that teachers benefit from training directly focused on integration. There was an overall growth in the ability to plan lessons with integrated technology.

This study does not support previous research on the effectiveness of collaboration among teachers in staff development (Glatthorn, 1987; Foa, Schwab, and Johnson, 1999; Cennamo, 1998), so more study of the role of a partner or collaborative model of planning would be useful. Because we can expect equal variance in ability to use the technology among the participants, the collaborative approach, not only in the planning phase of integration, but in the delivery of lessons is a model that warrants further study as it relates to the planning phase of integration and the delivery of lessons. This study can be extended by exploring not only teachers' ability to plan effective integrated methods, but also to use these lessons in practice. In this case it may be beneficial to focus on developing lesson plans for lessons in only one subject area to narrow the focus. While only the checklist portion of The State of Georgia Instructional Technology Implementation Observation (Moersch, 2001) was used in this study, the observation portion could be valuable in exploring the next step of the current study, which is taking the ability to plan lessons with integrated technology into practice.

APPENDICES

A. Description of Session 1:

B. Description of Session 2:

C. Description of Session 3:

D. Description of Levels of Technology Implementation distributed at session two.

E. Statement for Collecting Lesson Plans

F. Form for submitting Lesson Plans

G. Levels of Technology Integration Checklist for assessing Lesson Plans

APPENDIX A

DESCRIPTION OF SESSION 1

Session 1: Using the Internet for Instruction

Agenda from Session 1:

A. Teaching a specific Topic
    - Find 1-3 sites for students to use for information gathering.
    - Bookmark these sites, or link them from your website.
    - Create a guide to help students gather information.

B. Internet Research
    - Help students to distinguish between reliable and unreliable sources.
    - Prior to searching, have students brainstorm possible search keywords.
    - Provide a guide for recording internet research.

Search Engines for kids:

- www.yahooligans.com
- www.askjeeves.com

Description of Session 1:

This session was held in the computer lab, and each participant was seated at a computer. Those in the experimental group sat with their partners.

Two approaches to using the internet in the classroom were discussed. The first was using a computer center to address a certain topic. In this case it was recommended that teachers narrow the scope for students to two to four websites depending on age, and provide a guide or response sheet to focus students on the topic. Figure 1 is an example of a guide was given to participants:

Figure 1

PLANET NOTES

1. What planet are you researching?
2. Why did you choose this planet?
3. What planets are next to this planet?
4. List at least three facts about this planet.

Participants were given time to search for websites on a topic they were currently teaching, or would be teaching in upcoming weeks. They were shown how to copy and paste the

URLs on to a Word document to develop their guide, and how to bookmark the site for student use.

The second approach discussed was the use of the internet for research. In this case the students would be locating the sites and gathering information. The search engines listed on the agenda were given to assist teachers in finding student-friendly sites quickly, and to be used for student searching.

After this approach was discussed, participants were asked to visit each of the two search engines and find websites appropriate to a topic they were studying in class. They brainstormed to develop some guiding questions to help students narrow their searches. Those in the control group worked on this individually, while those in the experimental group worked on this individually. Teachers were then asked to designate a time when they could bring their class to the computer lab to implement the lesson they created, or planned to make the lesson a center on the classroom computer.

APPENDIX B

DESCRIPTION OF SESSION 2

Session 2: Using Technology to Meet TAAS Objectives

Agenda from Session 2:

- Organizing by TAAS Objective
  - http://www.tea.state.tx.us/student.assessment/resources/guides/educator/index.html
- Organizing by TAKS/TEKS Objective
  - http://www.tea.state.tx.us/student.assessment/taks/booklets/index.html
- Organizing by Theme
- Developing Centers

Description of Session 2:

In this session, again participants were in the computer lab, and had access to the computers to try the activities being discussed and demonstrated. Different ways to meet specific TAAS Objectives with technology, such as using websites to practice summarization, and using spreadsheets to convert tallying to graphs, were demonstrated, allowing differentiation to meet student needs. Various organizational techniques were discussed such as focusing on a certain objective and building a lesson or center activity around it, or starting with a theme and then addressing TAAS objectives within the theme. Use of search engines appropriate for children and using technology in centers were reviewed from Session 1.

After these approaches were discussed, teachers used the grids in Figure 2 and Figure 3 for brainstorming and planning lessons addressing TAAS objectives. Those who were using a particular theme in class filed in ideas in the grid within the theme. They were not encouraged to fill in every square, but to begin by developing ideas for a few objectives, and to address others at a later time. Teachers then explored websites and used other software to begin developing lessons designed to address a certain TAAS objective. It was suggested that these lessons be implemented in centers so that students would be able to work on specific objectives in which they were deficient. Another suggestion was that each child be given a notecard with an activity (lesson) on it targeting deficiencies and the whole class could then work in the lab, but still achieve differentiated instruction.

Participants in the control group worked on the grid and lessons individually, while those in the experimental group worked in teams.

Figure 2

Reading Objectives	internet	spreadsheets	database	multimedia presentation
Word Meaning				
Supporting Ideas				
Summarization				
Relationships and Outcomes				
Inferences and Generalizations				
Point of View, Propaganda, Fact and Opinion				

Figure 3

Math Objectives	internet	spreadsheets	database	multimediapres entation
number concepts				
Mathematical Relations and Functions				
Geometry				
Measurement Concepts				
Addition				
Subtraction				
Multiplication				
Division				
Estimation				
Problem solving Using Solutions Strategies				
Mathematical Representation				
Reasonableness				

APPENDIX C

DESCRIPTION OF SESSION 3

Session 3: Technology Integration

Teachers were asked to sit at tables according to birth month. Participants were given the Levels of Technology Implementation (see attachment 4) and each level was discussed. Then each table was given a sheet of butcher paper with a subject area (language, math, reading, health, science, and social studies) on it. Each table brainstormed ways to use technology in the subject area on their paper. The papers were then passed to another table which added ideas to the list. After the papers had been passed four times each table shared their best idea.

Next, participants were given the lesson planning sheet in Figure 4 and an example lesson plan, and began developing lessons from the ideas brainstormed previously.

Participants in the control group wrote their lesson plans individually, while those in the experimental group worked with their partners to develop their lesson plans.

Figure 4:

Curriculum	
Instruction	
Assessment	

APPENDIX D

DESCRIPTION OF LEVELS OF TECHNOLOGY IMPLEMENTATION DISTRIBUTED AT SESSION TWO

Levels of Technology Implementation (LoTi) Breakdown	
Level 0	**Non-Use**
Level 1	**Awareness**
Level 2	**Exploration**
Level 3	**Infusion**
Level 4a	**Integration (Mechanical)**
Level 4b	**Integration (Routine)**
Level 5	**Expansion**
Level 6	**Refinement**

Level 0 – Non-Use
Description:

A perceived lack of access to technology-based tools (e.g., computers) or a lack of time to pursue electronic technology implementation. Existing technology is predominately text-based (e.g., ditto sheets, chalkboard, overhead projector).

Classroom Observations:

- No visible evidence of computer access in the classroom
- Classroom computers sit idle during the instructional day

Level 1 – Awareness
Description:

The use of technology-based tools is either (1) one step removed from the classroom teacher (e.g., integrated learning system labs, special computer-based pull-out programs, computer literacy classes, central word processing labs), (2) used almost exclusively by the classroom teacher for classroom and/or curriculum management tasks (e.g., taking attendance, using grade book programs, accessing email, retrieving lesson plans from a curriculum management system or the internet) and/or (3) used to embellish or enhance teacher-directed lessons or lectures (e.g., multimedia presentations).

Classroom Observations:

- Available classroom computer(s) are used exclusively for teacher productivity (e.g., email, word processing, grading programs)
- Multimedia applications (including web-based) are used to embellish classroom lectures or teacher presentations
- Curriculum management tools are used extensively to generate standards-driven lesson plans

Level 2 - Exploration
Description:

Technology-based tools supplement the existing instructional program (e.g., tutorials, educational games, basic skill applications) or complement selected multimedia and/or web-based projects (e.g., internet-based research papers, informational multimedia presentations) at the knowledge/comprehension level. The electronic technology is employed either as extension activities, enrichment exercises, or technology-based tools and generally reinforces lower cognitive skill development relating to the content under investigation.

Classroom Observations:

- Student projects (e.g., designing web pages, research via the Internet, creating multimedia presentations, creating graphs and charts) focus on lower levels of student cognition (e.g., creating a web page to learn more about whale species)
- There is greater emphasis on the technology rather than on the critical content (e.g., "My students' project was to create a WebQuest using Inspiration and HyperStudio. The topic was the California Gold Rush.")
- Computer use serves as a reward station or as a digital babysitter
- Students were gathering weather data and keyboarding the information into a wide-area network database (e.g., GLOBE project)

Level 3 – Infusion
Description:

Technology-based tools including databases, spreadsheet and graphing packages, multimedia and desktop publishing applications, and internet use complement selected instructional events (e.g., field investigation using spreadsheets/graphs to analyze results from local water quality samples) or multimedia/web-based projects at the analysis, synthesis, and evaluation levels. Though the learning activity may or may not be perceived as authentic by the student, emphasis is, nonetheless, placed on higher levels of cognitive processing and in-depth treatment of the content using a variety of thinking skill strategies (e.g., problem-solving, decision-making, reflective thinking, experimentation, scientific inquiry).

Classroom Observations:

- Student use of tool-based applications such as spreadsheets/graphing, concept mapping, and databases is used primarily for analyzing data, making inferences, and drawing conclusions from an investigation or related scientific inquiry.
- Students are involved with different forms of "WebQuest" projects that require students to research information, draw conclusions from their research, and post them either to a web page or incorporate them into some form of multimedia presentation.
- Students use the web for research purposes or interact with selected software applications that require them to take a position or role play an issue (e.g., Tom Snyder Productions' "Decisions, Decisions").

Level 4a – Integration (Mechanical)
Description:

Technology-based tools are integrated in a mechanical manner that provides rich context for students' understanding of the pertinent concepts, themes, and processes. Heavy reliance is placed on prepackaged materials and/or outside resources (e.g., assistance from other colleagues), and/or interventions (e.g., professional development workshops) that aid the teacher in the daily management of their operational curriculum. Technology (e.g., multimedia, telecommunications, databases, spreadsheets, word processing) is perceived as a tool to identify and solve authentic problems as perceived by the students relating to an overall theme/concept. Emphasis is placed on student action and on issues resolution that require higher levels of student cognitive processing and in-depth examination of the content.

Classroom Observations:

- Students designed a school-based information kiosk to assist their classmates with various "safety" issues including map directions to school based on the time of day, neighborhood watch sites, and "just-say-no" strategies to use with strangers. The information collected for the information kiosk was supplied from student-generated surveys, field investigations, and personal interviews.
- Students organized a school fund-raiser to raise money for one of the international "solar cooker" societies based on their research, experimentation, and data gathering with homemade solar cookers.
- Students created a travel brochure for families traveling within the state of Florida that included: (1) a guide for selecting the best modes of travel based on the time of year, (2) recommended lodging based on information collected from various travel sites, and (3) a listing of the best destination sites based on criteria established by the students.

Level 4b – Integration (Routine)
Description:

Technology-based tools are integrated in a routine manner that provides rich context for students' understanding of the pertinent concepts, themes, and processes. At this level, teachers can readily design and implement learning experiences (e.g., units of instruction) that empower students to identify and solve authentic problems relating to an overall theme/concept using the available technology (e.g., multimedia applications, internet, databases, spreadsheets, word processing) with little or no outside assistance. Emphasis is again placed on student action and on issues resolution that require higher levels of student cognitive processing and in-depth examination of the content.

Classroom Observations:

- Based on the rise in student violence on campus, students prepared a multimedia presentation highlighting their recommended mediation strategies using data synthesized from school-wide surveys and from the internet.
- Students created a web site devoted to exploring solutions to the steady increase in solid wastes entering the local landfill.

- Students prepared a multimedia presentation highlighting the misconceptions and omissions in history text books concerning the contributions of their specific ethic group. Presentation was later burned onto a CD for submission to the various textbook publishers for consideration.
- Students investigated options for salvaging the local "fish ponds" as a way of preserving their native Hawaiian culture. Students prepared a community campaign including the creation of a web-page to persuade the voters not to approve a local housing tract proposal that would jeopardize the integrity of these ancient fish ponds.

Level 5 - Expansion
Description:

Technology access is extended beyond the classroom. Classroom teachers actively elicit technology applications and networking from other schools, business enterprises, governmental agencies (e.g., contacting NASA to establish a link to an orbiting space shuttle via internet), research institutions, and universities to expand student experiences directed at problem-solving, issues resolution, and student activism surrounding a major theme/concept. The complexity and sophistication of the technology-based tools used in the learning environment are now commensurate with (1) the diversity, inventiveness, and spontaneity of the teacher's experiential-based approach to teaching and learning and (2) the students' level of complex thinking (e.g., analysis, synthesis, evaluation) and in-depth understanding of the content experienced in the classroom.

Classroom Observations:

- Students created an actual online business venture involving cosmetics and jewelry as a culminating performance task in their marketing class.
- Students started their online consumer awareness clearinghouse that provided up-to-date information on "best prices" for travel, goods and merchandise, and services based on data collected from their research and online surveys with other schools.
- Using video cameras, NASA and NOAA images, and related weather and mapping data, students assisted a hiker in his goal to conquer the Continental Divide Trail from Mexico to Canada. Communicating via email, students were able to provide daily information on the best routes based on projected weather reports and various typographic information.

Level 6 – Refinement
Description*:*

Technology is perceived as a process, product (e.g., invention, patent, new software design), and/or tool for students to find solutions related to an identified "real-world" problem or issue of significance to them. At this level, there is no longer a division between instruction and technology use in the classroom. Technology provides a seamless medium for information queries, problem-solving, and/or product development. Students have ready access to and a complete understanding of a vast array of technology-based tools to accomplish any particular task at school. The instructional curriculum is entirely learner-based. The content emerges based on the needs of the learner according to his/her interests, needs, and/or aspirations and is supported by unlimited access to the most current computer applications and infrastructure available.

Classroom Observations:

- Students designed an interactive web site for bilingual children to expedite their English language proficiency. The site included options for real-time conversations, tutorial sessions, and bilingual online bulletin boards.
- Students created a new type of housing design using some sophisticated CAD programs to improve the amount of heat transfer in future homes.

Source: http://www.peak.org/~labquest/NBEA/LoTi/lotibreak.html

APPENDIX E

STATEMENT FOR COLLECTING LESSON PLANS PRIOR TO STAFF DEVELOPMENT SESSIONS

Please describe a lesson that you have used in your class using the attached form. Attach this sheet to the lesson plan.

Name(s) ____

Grade Level ______________ Years Experience _____________________

☐ I don't mind if this lesson is shared with others.

☐ Please do not share this lesson with others.

APPENDIX F

FORM FOR SUBMITTING LESSON PLANS FOLLOWING STAFF DEVELOPMENT SESSIONS

Please describe a lesson that you will be able to use in your class in the future using the attached form. Attach this sheet to the lesson plan.

Name(s) ____

Grade Level ______________ Years Experience _____________________

☐ I don't mind if this lesson is shared with others.

☐ Please do not share this lesson with others.

APPENDIX G

STATE OF GEORGIA INSTRUCTIONAL TECHNOLOGY

IMPLEMENTATION OBSERVATION

State of Georgia
Instructional Technology Implementation Observation

Date: ________________ **Observer(s):** ______________________________ **Grade Level:** ____________

Content: ______________________________________ **Position:** ❑ teacher ❑ student ❑ parent

Setting: ❑ classroom ❑ computer lab ❑ library media center ❑ other: ________________

Technology:

computer:
- ❑ writing/word processing
- ❑ slideshow/presentations
- ❑ hypermedia
- ❑ graphing
- ❑ graphics/drawing
- ❑ webbing/outlining
- ❑ database
- ❑ spreadsheet
- ❑ simulations
- ❑ tutorial
- ❑ drill & practice
- ❑ other: ____________

internet:
- ❑ research
- ❑ online course materials
- ❑ electronic field trips
- ❑ web projects
- ❑ web page creation
- ❑ video conferencing
- ❑ presentations
- ❑ email/keypals
- ❑ other: ________

video:
- ❑ viewing content info
- ❑ creating/editing
- ❑ broadcast TV
- ❑ video reports/original presentations
- ❑ viewing videotape for self-assessment
- ❑ distance learning/electronic field trips
- ❑ school news/announcements
- ❑ other: _______

other: ____

Observation:
Brief description of how technology was used in the learning experience:

The Learner:
Using technology, students:

Demonstrate high degree of knowledge in subject areas.
- ❑ understand or apply a concept
- ❑ develop or apply a skill
- ❑ build greater knowledge of a topic and how a topic relates to other content
- ❑ integrate new ideas with prior knowledge to make sense/meaning

Communicate subject matter clearly.
- ❑ articulate, present, and/or disseminate knowledge (e.g., written or video reports; multimedia projects)

Solve problems using an effective process to reach viable solutions.
- ❑ conduct research (e.g., locate, collect, organize, evaluate information)
- ❑ use higher order thinking skills (e.g., analysis, synthesis, divergent thinking)
- ❑ make decisions
- ❑ use models to test ideas

Apply learning to the world beyond the classroom.
- ❑ tie content learning to authentic/relevant situations outside the classroom
- ❑ exchange information or collaborate with others for purposeful problem-solving/issues resolution

Self-assess work and work process in order to set future goals.
- ❑ plan how to reach learning goals
- ❑ are aware of their progress in reaching learning levels
- ❑ are aware of the quality and quantity of their work

Comments/Evidence

State of Georgia
Instructional Technology Implementation Interview

Date: ________________ Interviewer: ________________________________

Content: ________________________________ Grade Level: ________________

1. Did today's observation represent a typical day of computer use?

2. If not, could you describe a typical day when computers are being used in terms of:
   - The setting:
   - The Technology Applications:
   - Student Use of Technology:

3. How often does this type of use occur?

4. What variables/obstacles restrict how you used computers?

Level of Technology Implementation:

✓	*Category*	*Pedagogy*	*Description*
❑	Nonuse	Traditional methods/ materials	❑ Technology is not in use. (Ask the teacher about actions toward incorporating technology; comment below.) ❑ Materials are traditional and predominately text-based (e.g., blackboard, overhead, textbooks, workbooks).
❑	Awareness	Technology centered; instruction is about or predominately ontrolled by the technology.	❑ A person other than the regular classroom teacher (e.g., resource person or assistant) delivers instruction using technology or the technology determines the instruction (e.g., through an ILS). ❑ Technology use has no or little relevance to the teacher's overall instructional program or to student mastery of appropriate content. ❑ The primary learning goal of the lesson is to acquire technical skills or technology literacy (e.g., how to use specific software; learning about hardware; keyboarding; technology vocabulary) and is separate from or in addition to (an) academic goal(s). ❑ Technology use is separate from the learning focus (e.g., offered as a reward activity or allowed when "real work" is completed). ❑ Technology use occurs only at scheduled times; access is limited/not available beyond the schedule. ❑ Available classroom computer(s) are used exclusively for teacher productivity (e.g., email, word processing, grading programs). ❑ Multimedia applications (including web-based) are used to embellish classroom lectures or teacher presentations. ❑ Curriculum management tools are used extensively to generate standards-driven lesson plans.
❑	Exploration	Teacher centered; teacher directed instruction; technology use or mastering content is peripheral or dispensable.	❑ Student activities, discussions, and projects are focused more on the technology than on the academic content. ❑ Student work is produced to develop or practice technology skills rather than having the content learning objective drive the technology use. ❑ Technology supplements the existing instructional program and is used for extension activities or enrichment exercises. ❑ Technology is used for low level cognitive tasks (e.g., content drill and games for skills practice) related to specific, explicit learning goals. ❑ Student work produced using technology requires little analysis or individual creativity and insight. ❑ Technology tasks are simplistic and use a "cookie cutter"/look-alike approach to what is required. ❑ The primary purpose for using technology is to sustain student interest in content and learning or to increase student time on task rather than to develop concepts or content skills. ❑ Technology's role in the learning activity is disjointed, uneven, or uncertain. ❑ The use of technology seems optional and unnecessary to achieve the learning goals; the match between instructional goals and technology use seems forced or superficial.
❑	Infusion	Teacher centered; teacher directed instruction; technology use for mastering content is adapted to fit with traditional goals and tasks.	❑ Use of productivity tools such as spreadsheets/graphing packages, concept mapping, and databases are used primarily for analyzing information, making inferences, and drawing conclusions from an investigation or related inquiry. ❑ Students are involved with different forms of web-based projects (e.g., WebQuest) that require students to research information, draw conclusions from their research, and post them to either a web page or incorporate them into some form of multimedia presentation. ❑ The web is used for research purposes or to interact with selected software applications (e.g., simulations) that require students to take a position or role play an issue. ❑ Technology is used for higher cognitive tasks (e.g., analyzing data from a survey, creating a decision-making matrix) related to specific, explicit learning goals. ❑ Technology is used to enhance alternative assessment schemes (e.g., performance-based assessment) that demonstrate higher cognitive skill use (e.g., analysis, synthesis, evaluation) and/or provide evidence of complex thinking skill strategies (e.g., problem-solving, decision-making, investigation, scientific inquiry). ❑ Technology provides adaptations in activities, assessments, and materials for special populations.
❑	Integration (Mechanical)	Student centered, constructivist instruction; technologies are used for collaborative project-based instruction.	❑ Teachers rely on prepackaged materials, instructional designs (e.g., 4-MAT, EBAM, Understanding by Design, Learning in Overdrive) and/or outside resources to implement student-centered learning experiences using the available classroom technology. ❑ Technology (e.g., multimedia, telecommunications, databases, spreadsheets, word processing) is used as a tool to help students identify and solve authentic problems relating to an overall theme/concept; however, the teacher's personal management concerns and/or perceived infrastructure barriers may restrict full implementation. ❑ Emphasis is placed on authentic problem-solving, student action, and/or issues resolution that require higher levels of student cognitive processing and in-depth examination of the content; yet teacher's personal management concerns and/or perceived infrastructure barriers may limit student options. ❑ Technology use encourages and enables student choice and decision-making during instruction; however, personal management concerns and/or perceived infrastructure barriers may limit student options. ❑ Technology use promotes collaboration among students for planning, implementing, and evaluating their work; yet personal management concerns and/or perceived infrastructure barriers on behalf of the teacher still exist. ❑ Students use a variety of technologies in assessment activities to show evidence of understanding (e.g., to analyze information, synthesize or produce new information, evaluate products); yet personal management concerns and/or perceived infrastructure barriers on behalf of the teacher about alternative assessment still exist.

Level of Technology Implementation:

✓	*Category*	*Pedagogy*	*Description*
❑	Integration (Routine)	Student centered, constructivist instruction; technologies are used for collaborative project-based instruction.	❑ Teacher can readily design and implement learning experiences (e.g., units of instruction) that empower students to identify and solve authentic problems relating to an overall theme/concept using the available technology (e.g., multimedia applications, internet, databases, spreadsheets, word processing) with little or no outside assistance. ❑ Technology (e.g., multimedia, telecommunications, databases, spreadsheets, word processing) is used as a tool to help students identify and solve authentic problems relating to an overall theme/concept; the teacher is confident and comfortable with using technology in this context. ❑ Emphasis is placed on authentic problem-solving, student action, and/or on issues resolution that requires higher levels of student cognitive processing and in-depth examination of the content; the teacher has the background and confidence to nurture this type of instructional strategy on an ongoing basis. ❑ Technology use encourages and enables student choice and decision-making during instruction. ❑ Technology use promotes collaboration among students for planning, implementing, and evaluating their work directed at authentic problem-solving, issues resolution, and/or student action. ❑ Students use a variety of technologies in assessment activities to show evidence of understanding (e.g., to analyze information, synthesize or produce new information, evaluate products) relating to an authentic performance task.
❑	Expansion	Constructivist instruction in which students and teachers are facilitators, learners, and researchers; technologies support self-directed, collaborative learning.	❑ Technology extends the classroom by expanding student experiences and collaboration beyond the school and local community ("classrooms without walls"). ❑ Collaborative learning experiences involving other schools, business enterprises, governmental agencies (e.g., contacting NASA to establish a link to an orbiting space shuttle via internet), research institutions, and/or universities are established to expand student experiences directed at problem-solving, issues resolution, and student activism surrounding a major theme/concept. ❑ Students initiate using technology appropriately for self-directed learning and assessment, including for portfolios. Students select and use technology to investigate topics, to create original products, to communicate knowledge, and to demonstrate mastery of complex skills and concepts (students as creators/producers, communicators, and assessors of knowledge). ❑ The complexity and sophistication of the technology-based tools used in the learning environment are commensurate with (1) the diversity, inventiveness, and spontaneity of the teacher's experiential-based approach to teaching and learning and (2) the students' level of complex thinking (e.g., analysis, synthesis, evaluation) and in-depth understanding of the content experienced in the classroom.
❑	Refinement	Constructivist instruction in which students and teachers are facilitators, learners, and researchers; technologies support self-directed, collaborative learning.	❑ Technology is a seamless tool used by students through their own initiative to find solutions related to an identified "real-world" problem or issue of significance to them. Technology provides a seamless medium for information queries, problem-solving, and/or product development. ❑ Students and teachers have ready access to and a complete understanding of a vast array of technology-based tools to accomplish any particular task at school. ❑ The instructional curriculum is entirely learner-based. The content emerges based on the needs of the learner according to his/her interests, needs, and/or aspirations, and is supported by unlimited access to the most current computer applications and infrastructure available. ❑ Students seek innovative ways to incorporate new uses of technology into their learning experiences and develop new technology skills as needed for self-directed, purposeful projects.

Comments:

Sources for the Level of Technology Implementation (LoTi) Continuum:

Moersch, C. (1995). Levels of technology implementation (LoTi): A framework for measuring classroom technology use. http://www.learning-quest.com/LoTi/

Arlington Public Schools, VA, Office of Instructional Media & Technology, Instructional Design & Evaluation. http://www.arlington.k12.va.us/departments/IMT/

RESOURCES

Albaugh, Patti (1997). *The Role of Skepticism in Preparing Teachers for the Use of Technology*. Presented at “Education for Community”: A Town and Gown Panel Discussion. Westerville, OH.

Atkins, Nancy E. and Vasu, Ellen S. (1998). *The Teaching with Technology Instrument*. Learning and Leading with Technology; v.25 n.8 p. 35-39.

Bailey, Gerald and Pownell, David (1998). *Technology Staff Development and Support Programs*. Learning and Leading with Technology, 26, 3, 47-51.

Bosch, Karen A. (1993). Is there a Computer Crisis in the Classroom? *Schools in the Middle*, Summer, 7-19.

Brand, Glenn A.(1998). What Research Says: Training Teachers for Using Technology. *Journal of Staff Development*, Vol. 19, No. 1, 10-13.

Braun, Joseph A., Fernlund, Phyllis, and White, Charles (1998). *Technology Tools in the Social Studies Curriculum*. Franklin, Beedle and Associates, Wilsonville, OR.

Bray, Barbara (1999). Technology Staff Development That Works. *Learning and Leading with Technology*, Vol. 27, No. 3, p. 14-20.

Cennamo, Katherine S. (1998). Wait ‘till Ya Hear This One: Professional Development Through Anecdotes. Paper Presented at the National Convention of the Association for Educational Communications and Technology. St. Louis, MO.

Deal, T. and Peterson, K.D. (1990). *The Principal’s Role in Shaping School Culture*. Washington, D.C.: U. S. Department of Education.

Ertmer, Peggy A.; Hruskoce, Carole; Johnson, Tristan; Lai, Feng-Qi (1998). START (Student Trainers as Resource Technologists): An Alternative Approach to Technology Integration. Paper Presented at the National Convention of the Association for Educational Communications and Technology. St. Louis, MO.

Foa, Lin; Schwab, Richard; Johnson, Michael (1999). Introducing Technology Into the Schools: Triumph or Train Wreck. National Education Association Focus on Technology. Retrieved July 24, 1999 from the World Wide Web: http://www.nea.org

Fullan, Michael G. and Miles, Matthew B. (1992). Getting Reform Right: What Works and What Doesn't. *Phi Delta Kappan*. Bloomington, IN: Phi Delta Kappa International.

Glatthorn, Allan (1987). Cooperative Professional Development: Peer-Centered Options for Teacher Growth. *Educational Leadership*, November, 31-35.

Goldman, Susan R., Williams, Susan M., Sherwood, Robert D., Hasslebring, Ted S. (1999). *Technology for Teaching and Learning with Understanding: APrimer*. New York, NY: Houghton Mifflin Co.

Gredler, M.E. (1996). *Program Evaluation*. Englewood Cliffs, NJ: Simon and Schuster.

Hall, Gene E.; Hord, Shirley M. (1987). *Change in Schools: Facilitating the Process*. State University of New York-Albany: SUNY Press.

Healy, Charles C. and Welchert, Alice J. (1990). Mentoring Relations: A Definition to Advance Research and Practice. *Educational Researcher*, 19, 9 17-21.

Hord, Shirley M.(1985). *Collaboration or Cooperation: Comparisons and Contrasts, Dilemmas and Decisions*. Paper presented at the Meadow Brook Symposium on Collaborative Action Research in Education; Oakland University.

.

Hord, Shirley M.(1992). *Facilitative Leadership: The Imperative for Change*. Austin, TX: Southwest Educational Development Laboratory.

Hord, Shirley M.; Rutherford, William L.; Huling-Austin, Leslie; Hall, Gene E. (1998). *Taking Charge of Change*. Austin, TX: Southwest Educational Development Laboratory.

Horsley, Donald and Kaser, Joyce (1999). *How to Keep a Change Initiative on Track*. National Staff Development Council, Fall, 40-45.

Hunter, Barbara, Bagley, Carole, and Bagley, Richard (1993). Technology in the Classroom: Preparing Students for the Information Age. *Schools in the Middle*, Summer, 3-6.

Joyce, Bruce and Calhoun, Emily (1989). *Creating Learning Experiences: The Role of Instructional Theory and Research*. Alexandria, VA: Association for Supervision and Curriculum Development.

Khan, Badrul H. (1995). Obstacles Encountered During Stages of the Educational Change Process. *Educational Technology*, March-April, 43-46.

Knapczyk, Dennis, Rodes, Paul, Brush, Thomas, Champion, Mary Ann, and Hubbard, Lori (1991). *Improving Staff Development in Rural Communities*. Indiana University, Indiana.

Knezek, Gerald, Christensen, Rhonda, Miyashita, Keiko, and Ropp, Margaret (2000). Instruments for Assessing Educator Progress in Technology Integration. Denton, TX: University of North Texas.

Kumari, Siva (1996). Teaching with the Internet. Center for Technology in Teaching and Learning. Retrieved September 10, 2001 from the World Wide Web: http://www.uvm.edu/~hag/naweb96/zkumari.html

Land, Michael (1997). Helping Teachers Integrate Internet Resources into the Curriculum. *NASSP Bulletin*, November, 58-65.

Leithwood, K. and Jantzi, D. (1990). Transformational Leadership: How Principals Can Help Reform School Cultures. School Effectiveness and School Improvement, 1(4), 249-280.

Louis, Karen Seashore and Marks, Helen (1998). Does Professional Community Affect the Classroom? Teachers' Work and Student Experiences in Restructuring Schools. *American Journal of Education*, 108, 533-573.

Lowe, Michael and Vespestad, Karen (1999). Using Technology as a Tool to Enhance Teaching and Learning. *NASSP Bulletin*, May 1999, 31-37.

Marshall, Gail (1995). Money isn't Everything: Prospects and Problems in Achieving the Aims of the Computer Revolution. Presented at the National Education Computing Conference. Baltimore, MD.

Mahaffy, J.E. (1988). *Collegial Support System: A Process Model Draft*. Portland, OR: Northwest Regional Education Laboratory.

McQueen, Candice (2001). Teaching to Win. *Kappa Delta Pi Record*, 38, 1, 12-15.

Milone, Michael (1999). Staff Development: The Inside Story. *Technology and Learning*, 20, 3, 54-59.

Moersch, Christopher (2002). Personal Communication February 22, 2002.

Moersch, Christopher (2001). *State of Georgia Instructional Technology Implementation Observation.*

Moersch, Christopher (1995). *Levels of Technology Integration Implementation* (LoTi): Retrieved November 19, 2001 from the World Wide Web: http://www.learning-quest.com/LoTi/level0.html

Moersch, Christopher (1995). Levels of Technology Integration Implementation (LoTi): A Framework for Measuring Classroom Technology Use. *Learning and Leading with Technology*. p. 40-42.

North Carolina State Department of Public Instruction (1998). Technology Training for Teachers: Topics and Tips for Staff Development Planners. Raleigh, NC.

Norton, Priscilla and Wiburg, Karin M. (1998). *Teaching with Technology*. Fort Worth, TX: Harcourt Brace College Publishers.

Norum, Karen; Lowry, May (1995). The Heart of Educational Restructuring: Dealing with Change. Presented at the Annual Meeting of the Association for Educational Communications and Technology. Anaheim, CA.

Peterson, K.D. (1988). Mechanisms of Culture Building and Principals' Work. *Education and Urban Society*, 20(3), 250-261.

Pisipia, John, Coukos, Eleni, and Knutson, Kimberly (2000). The Impact of Computers on Teacher Capacity, Attitudes, and Behaviors in Elementary Schools. Presented at the Annual Meeting of the American Educational Research Association. New Orleans, LA.

Ropp, Margaret Merlyn. (1999.) Technology Proficiency Self-Assessment. Will new teachers be prepared to teach in a digital age? A national survey on information technology in teacher education. Santa Monica, CA: Milken Family Foundation. Downloaded from the World Wide Web December 5, 2000 at http://129.120.113.31/surveys/tpsa2.html

Sarason, Seymore. (1995). *School Change: The Personal Development of a Point of View*. New York: Teachers College Press.

Schein, E.H. (1989). Organizational Culture and Leadership. San Francisco:Jossey-Bass.

Schwab, Richard and Foa, Lin (2001). Integrating Technologies into Our Schools. *Phi Delta Kappan*, 82, 8 620-624.

Sparks, Dennis and Louks-Horsely, Susan. (1990). *Five Models of Staff Development for Teachers*. Oxford, OH: National Staff Development Council.

Stoll, Louis and Fink, Dean. (1996). *Changing our Schools: Linking School Effectiveness and School Improvement*. Buckingham: Open University Press.

Vojtek, Bob and Vojtek, Rosie O'Brien (1999). Flung into Motion. National Staff Development Council, Winter, 67-69.

Waxman, Hersholt C. and Walberg, Herbert J. (1999). *New Directions for Teaching Practice and Research*. McCutchan Publishing Corporation, Berkeley, CA.

Zepeda, Sally J. (1999). *Staff Development: Practices that Promote Leadership in Learning Communities*. Larchmont, NY: Eye on Education, Inc.